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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/023,745	12/21/2001	Woo Sik Kim	P-0306	5310

34610 7590 08/24/2005

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EXAMINER	
LEUNG, CHRISTINA Y	
ART UNIT	**PAPER NUMBER**
2633	

DATE MAILED: 08/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/023,745	KIM ET AL.	
	Examiner	**Art Unit**	
	Christina Y. Leung	2633	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 June 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-42* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 June 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings were received on 08 June 2005. These drawings are acceptable.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2, 6-8, and 10-42 are rejected under 35 U.S.C. 102(b) as being anticipated by Russell et al. (US 5,627,879 A).

Regarding claim 1, Russell et al. disclose a communications system (Figures 17, 27A, 27B, 28, and 29), comprising:

a base station (base station 330 shown in Figure 17, connected to a "Head End" element including head end unit 332 and modulator/demodulator element 338 shown in detail in Figures 27B and 28 respectively) configured to output first digital in phase and quadrature phase (I/Q) signals (such as the quadrature amplitude modulated [QAM] signals output from modulator 460 in Figure 28; column 17; lines 31-36);

an optical connecting unit (AM optical transmitter 462 in Figure 28) configured to convert the first digital I/Q signals into optical signals and output the converted optical signals through an optical cable 340A (column 17, lines 35-36); and

an optical base station (optical node 342 in Figure 17 and shown in detail in Figure 29) coupled to receive the optical signal through the optical cable 340A and configured to convert

the optical signals into second digital I/Q signals (using AM optical receiver 500 in Figure 29; column 17, lines 43-45), and convert the second digital I/Q signals into first RF signals for transmission (using QAM demodulator 502 and digital-to-analog converter 504 in Figure 29; column 17, lines 45-53).

Examiner notes that although Russell et al. do not specifically use the term "I/Q signals" in their disclosure, it is well understood in the communications art that quadrature amplitude modulated (QAM) signals *are* digital in phase and quadrature phase signals due to the nature of the modulation which defines QAM signals. Therefore, Russell et al. inherently disclose "digital I/Q signals" because they disclose QAM signals.

Regarding claim 2, Russell et al. disclose that the optical base station (Figure 29) comprises:

an optical transceiver (including AM optical receiver 500; column 17, lines 43-45) configured to convert the optical signals received through the optical cable into the second digital I/Q signals;

a multiplexer/demultiplexer unit (QAM demodulator 502; column 17, lines 45-48) configured to demultiplex the second digital I/Q signals outputted from the optical transceiver;

an up-converter (mixer 506; column 17, lines 48-51) configured to convert and filter an output signal of the multiplexer/demultiplexer unit and output the first RF signals;

a high power amplifier 510 configured to amplify the first RF signals outputted by the up-converter; and

a duplexer 514 configured to filter the amplified first RF signals and provide the filtered output to an antenna 516 (column 17, lines 51-53).

Regarding claim 6, Russell et al. disclose that the antenna elements in the optical base station (Figure 29) includes a diversity antenna 520 (column 17, lines 57-62).

Regarding claim 7, Russell et al. disclose that the optical connecting unit (Figure 28) comprises:

a multiplexer/demultiplexer (QAM modulator 460; column 17, lines 33-36) configured to multiplex the first digital I/Q signals;

optical transceiver (including AM optical transmitter 462) configured to convert output signals of the multiplexer/demultiplexer into the optical signals and transmit the optical signals through the optical cable 340A to the optical base station; and

a clock unit configured to provide a synchronous signal to the multiplexer/demultiplexer unit (not explicitly shown, but disclosed in column 31, lines 3-9).

Regarding claim 8, Russell et al. discloses that the optical transceiver (including AM optical receiver 466 in Figure 28) is further configured to receive optical signals from the optical base station and convert the received optical signals into third digital I/Q signals to be transmitted to the base station (column 17, lines 36-41).

Regarding claim 10, Russell et al. disclose that the optical base station and the optical connecting unit are digital interface-based devices (column 16, lines 65-67; column 1, lines 1-2).

Regarding claim 11, as similarly discussed above with regard to claim 1, Russell et al. disclose a signal transmitting method for a communications system (Figures 17, 27A, 27B, 28, and 29), comprising:

converting first digital I/Q signals outputted from a base station into optical signals (using AM optical transmitter 462 in element 338 in Figure 28; column 17, lines 35-36);

transmitting the optical signals through an optical cable 340 A to an optical base station (optical node 342 in Figure 29);

converting the optical signals received through the optical cable into second digital I/Q signals (using AM optical receiver 500 in optical node 342; column 17, lines 43-45);

converting the second digital I/Q signals into RF signals (using QAM demodulator 502 and digital-analog converter 504 in optical node 342; column 17, lines 45-53); and

transmitting the RF signals through an antenna 516 (column 17, lines 51-53).

Regarding claim 12, Russell et al. disclose that converting the second digital I/Q signals to RF signals comprises:

demultiplexing the second digital I/Q signals (using QAM demodulator 502 in Figure 29); column 17, lines 45-48);

converting the demultiplexed signals to analog signals (using digital-to-analog converter 504);

band pass filtering the analog signals to generate the RF signals (using mixer 506; column 17, lines 48-51);

high-power amplifying the RF signals (using amplifier 510); and

filtering the amplified RF signals (using filter 512; column 17, lines 51-53).

Regarding claim 14, Russell et al. disclose that converting the first digital I/Q signals to the optical signals comprises multiplexing the first digital I/Q signals (using QAM modulator 460 in Figure 28; column 17, lines 33-36).

Regarding claims 13 and 15, Russell et al. disclose that demultiplexing and multiplexing is performed in accordance with a synchronous signal (column 31, lines 43-60).

Regarding claim 16, Russell et al. disclose the antenna comprises a diversity antenna 520 (Figure 29; column 17, lines 57-62).

Regarding claim 17, Russell et al. disclose receiving RF signals through the antenna (column 17, lines 53-59).

Regarding claim 18, Russell et al. disclose a signal receiving method for a communications system (Figures 17, 27A, 27B, 28, and 29), comprising:

receiving RF signals through an antenna 516 of a first station (optical node 342 shown in Figure 29; column1 7, lines 53-59);

converting the received RF signals to first digital electronic signals (using analog-to-digital converter 534 and QAM modulator 536; column 17, lines 59-61) ;

converting the first digital electronic signals to digital optical signals (using AM optical transmitter 538; column 17, lines 63-65);

transmitting the digital optical signals over an optical link 340B to an optical connecting unit (element 338 in Figure 28; see also Figure 17);

converting the digital optical signals to second digital electronic signals in the optical coupling unit (using AM optical receiver 466; column 17, lines 36-39), the second digital electronic signals including in phase and quadrature phase (I/Q) signals; and

providing the second digital electronic signals from the optical coupling unit to a second station (such as base station 30 as shown in Figure 17).

Again, Examiner notes that although Russell et al. do not specifically use the term "I/Q signals" in their disclosure, it is well understood in the communications art that quadrature amplitude modulated (QAM) signals *are* digital in phase and quadrature phase signals due to the

nature of the modulation which defines QAM signals. Therefore, Russell et al. inherently disclose "digital I/Q signals" because they disclose QAM signals.

Regarding claim 19, Russell et al. disclose that the optical link 340B comprises an optical cable (column 17, lines 62-65).

Regarding claim 20, Russell et al. discloses that the first station comprises a remote base station (optical node 342) and wherein the second station comprises a base station 330 (Figure 17).

Regarding claim 21, Russell et al. disclose that the antenna comprises a diversity antenna 520 (column 17, lines 57-62).

Regarding claim 22, Russell et al. disclose a communications system (Figures 17, 27A, 27B, 28, and 29), comprising:

means for converting first digital I/Q electronic signals outputted from a first station (base station 330 in Figure 17) into first digital optical signals (AM optical transmitter 462 in element 338 shown Figure 28; column 17, lines 31-36);

means for transmitting the first digital optical signals to a second station (AM optical transmitter 462 transmits the digital optical signal over fiber 340A to optical node 342);

means for converting the first digital optical signals to second digital electronic signals (AM optical receiver 500 in optical node 342 shown in Figure 29);

means for converting the second digital electronic signals to first RF signals(including digital-to-analog converter 504 and mixer 506; column 17, lines 43-51); and

means for transmitting the first RF signals (antenna 516).

Again, Examiner notes that although Russell et al. do not specifically use the term "I/Q signals" in their disclosure, it is well understood in the communications art that quadrature amplitude modulated (QAM) signals *are* digital in phase and quadrature phase signals due to the nature of the modulation which defines QAM signals. Therefore, Russell et al. inherently disclose "digital I/Q signals" because they disclose QAM signals.

Regarding claim 23, Russell et al. disclose that the first digital optical signals are transmitted to the second station using an optical cable 340A (column 17, lines 31-36).

Regarding claim 24, Russell et al. disclose means for amplifying and filtering the first RF signals prior to transmitting (amplifier 510 and filter 512 in Figure 29; column 17, lines 51-53).

Regarding claim 25,. Russell et al. disclose means for receiving second RF signals in the second station (antennas 516 and 520; column 17, lines 53-61);

means for converting the second RF signals to third digital electronic signals (analog-to-digital 534 and QAM modulator 536; column 17, lines 62-65);

means for converting the third digital electronic signals to second digital optical signals (AM optical transmitter 538);

means for transmitting the second digital optical signals over the optical link (AM optical transmitter 538);

means for converting the second digital optical signals to fourth digital electronic signals (AM optical receiver 466 in Figure 28); and

means for providing the fourth digital electronic signals to a second station (the fourth digital electronic signals are provided to a second station such as base station 330 in Figure 17 through QAM demodulator 464 in Figure 28 and elements in Figure 27B).

Regarding claim 26, Russell et al. disclose a signal transmitting method in a communication system (Figures 17, 27A, 27B, 28, and 29), comprising:

converting digital I/Q signals to optical signals in an optical connecting unit (using AM optical transmitter 462 in Figure 28);

transferring the optical signals over an optical cable 340A to a remote station (i.e., optical node 342 shown in Figure 29); and

converting the optical signals into RF signals for transmission (using AM optical receiver 500, QAM demodulator 502, digital-to-analog converter 504, mixer 506, etc. in the optical node as shown in Figure 29).

Regarding claim 27, Russell et al. disclose that the digital I/Q signals are received from a base station 330. Figure 17 shows the connection between base station 300 through head end unit 332, modulator/demodulator 338, and optical node 342.

Regarding claim 28, Russell et al. disclose that converting the optical signals comprises:

converting the optical signals into analog signals and demultiplexing the analog signals (using QAM demodulator 502, and digital-to-analog converter 504; column 45-51);

up converting and filtering the demultiplexed analog signals to generate the RF signal (using mixer 506; column 17, lines 48-51); and

amplifying and filtering the RF signals (using amplifier 510 and filter 512; column 17, lines 51-53).

Regarding claim 29, Russell et al. disclose converting the digital I/Q signals comprises multiplexing the digital I/Q signals (using QAM modulator 460 in Figure 28; column 17, lines

31-41) and inputting the multiplexed digital I/Q signals into an optical transceiver (AM optical transmitter 462) to generate the optical signals.

Regarding claim 30, Russell et al. disclose receiving external RF signals through an antenna coupled to the remote station (column 17, lines 53-65);

converting the external RF signals to second optical signals (using mixer 528, analog-to-digital converter 534, QAM modulator and AM optical transmitter 538 in Figure 29);

transferring the second optical signals to the optical connecting unit (through optical fiber 340B); and

converting the second optical signals to second digital I/Q signals (using AM optical receiver 466 and QAM demodulator 464 in Figure 28).

Regarding claim 31, Russell et al. disclose a communication system (Figures 17, 27A, 27B, 28, and 29), comprising:

an optical connecting unit ("Head End" element in Figure 17, including QAM modulator 460 and AM optical transmitter 462 shown in Figure 28), configured to receive first digital I/Q signals and convert the first digital I/Q signals into first digital optical signals (column 17, lines 31-36); and

a remote base station (optical node 342 in Figure 17, shown in detail in Figure 29), coupled to receive the first digital optical signals and configured to convert the first digital optical signal to first analog RF signals for transmission (column 17, lines 42-53).

Regarding claim 32, Russell et al. disclose that base station 342 is further configured to receive second RF analog signals and convert the second analog RF signals to second digital

optical signals (using mixer 528, analog-to-digital converter 534, QAM modulator and AM optical transmitter 538 in Figure 29; column 17, lines 53-65); and

that the optical connecting unit is coupled to receive the second digital optical signals and further configured to convert the second digital optical signals to second digital I/Q signals for transmission (using AM optical receiver 466 and QAM demodulator 464 shown in Figure 28; column 36-41).

Regarding claim 33, Russell et al. disclose a communication system, comprising:

an optical connection unit ("Head End" element in Figure 17, including elements shown in Figure 28), configured to convert first digital I/Q signals to first optical signals and to convert second optical signals to second digital I/Q signals (column 17, lines 31-41); and

a remote base station (optical node 342 in Figure 17, shown in detail in Figure 29), coupled to receive the first optical signals, and configured to convert the first optical signals to third digital I/Q signals, convert the third digital I/Q signals to first RF signals, transmit the first RF signals, receive second RF signals, convert the second RF signals to fourth digital I/Q signals, and convert the fourth digital I/Q signals to the second optical signals (column 17, lines 42-65).

Regarding claim 34, Russell et al. disclose an optical link coupling the optical connecting unit to the remote base station (fibers 340A and 340B) .

Regarding claim 35, Russell et al. disclose that the remote base station comprises a diversity antenna 520 (column 17, lines 57-62).

Regarding claim 36, Russell et al. disclose that the optical connecting unit comprises a multiplexer configured to multiplex the first digital I/Q signals and a demultiplexer configured to

demultiplex the second digital I/Q signals (QAM modulator 460 and QAM demodulator 464, respectively, in Figure 28; column 17, lines 31-41), and

that the remote base station comprises a demultiplexer configured to demultiplex the third digital I/Q signals and a multiplexer configured to multiplex the fourth digital I/Q signals (QAM demodulator 502 and QAM modulator 536, respectively, in Figure 29; column 17, lines 42-65).

Regarding claims 37-42, Russell et al. disclose converting the first digital I/Q signals from parallel to serial (column 8, lines 56-64).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Russell et al. in view of Gordon et al. (US 5,067,173 A).

Regarding claim 3, Russell et al. disclose a system as discussed above with regard to claim 2 and further disclose that the optical base station further comprises:

a plurality of filters 518 and 522 configured to remove a noise component of a second RF signal collected by a corresponding plurality of antennas 516 and 520;

a plurality of down-converter units (mixers 528 and 524 and analog-to-digital converter 534) configured to band-pass filter, down-convert and analog to digital convert, the second RF signals.

Russell et al. explicitly show one duplexer 514 but do not specifically disclose a plurality of duplexers. However, Russell et al. also already disclose that the optical base station may include a plurality of antennas for transmitting and receiving a plurality of channels (Figure 42). It would have been obvious to a person of ordinary skill in the art to provide a plurality of duplexers to correspond to a plurality of antennas in the system disclosed by Russell et al. in order to separate the incoming and outgoing signals from each other and ensure that they are properly processed.

Russell et al. also do not specifically disclose a plurality of amplifiers to amplify the second RF signals. However, Gordon et al. teach a system related to the one disclosed by Russell et al. including receiving RF signals at antennas (Figure 2). Gordon et al. further teach a plurality of amplifiers 204 and 212 configured to amplify RF signals outputted from the antennas. It would have been obvious to a person of ordinary skill in the art to include antennas as taught by Gordon et al. in the system disclosed by Russell et al. in order to ensure that the level of received RF signals is high enough for proper reception and processing.

Regarding claims 4 and 5, Russell et al. discloses that the optical base station further comprises a clock unit configured to provide a synchronous signal to the multiplexer/demultiplexer unit and further comprises a reference clock unit configured to provide the synchronous signal of the clock unit to the up-converter unit and the plurality of down-converter units (column 31, lines 10-18).

6. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Russell et al.

Regarding claim 9, Russell et al. disclose a system as discussed above with regard to claim 1 and further disclose that the optical connecting unit receives the first digital I/Q signal

from the base station 303 (shown in detail in Figure 27A), but they do not specifically disclose at least one channel card. However, channel cards are well known in the art as a widely available hardware implementation of the signal transmitting elements already disclosed by Russell et al. in the case station (Figure 27A shows transmitters 453). It would have been obvious to a person of ordinary skill in the art to specifically use transmitters implemented in channel cards in the base station disclosed by Russell et al. as an engineering design choice of a way to provide the transmitters using available and readily replaceable transmitter hardware.

Response to Arguments

7. Applicants' arguments filed 08 June 2005 have been fully considered but they are not persuasive.

Examiner respectfully disagrees with Applicants' assertion on page 19 of their response that "Russell does not multiplex I/Q signals within a base station. Rather, the QAM modulator 460 shown in Fig. 28 merely selects one of the input signals (i.e., DIGITAL/POTS/DATA IN signals, DIGITAL VIDEO signals or DIGITAL PCN/MICROCELL TRAFFIC) signals for transmission to the optical transmitter 462." On the contrary, Examiner respectfully notes that Russell et al. clearly disclose that the QAM modulator 460 multiplexes the plurality of input signals and does not merely select one of them:

"As illustrated in FIG. 28, QAM modulator 460 receives a digital POTS/data input signal, a digital video signal and a digital PCN/microcell traffic signal. *QAM modulator 460 multiplexes the input signals and produces a QAM modulated output signal* for application to AM optical transmitter 462, which is in turn applied to fiber 340A. On a return path, AM optical receiver 466 receives a QAM modulated signal from optical fiber 340B and applies an input to QAM demodulator 464. *Demodulator 464 demultiplexes the received signal and in turn produces a digital microcell/PCN signal and a digital POTS/data signal.*" (Russell et al., column 17, lines 31-43; italics added by Examiner)

Examiner also respectfully disagrees with Applicants' assertion on page 19 of their response that Russell et al. do not disclose digital I/Q signals. It is well understood in the communications art that quadrature amplitude modulated (QAM) signals *are* digital in phase and quadrature phase signals due to the nature of the modulation which defines QAM signals. In other words, QAM signals are digital I/Q signals by definition. Therefore, although Russell et al. do not specifically use the term "I/Q signals" in their disclosure, Russell et al. inherently disclose "digital I/Q signals" because they disclose QAM signals.

Regarding Applicants' comments on pages 20-21 of their response in particular, Examiner also respectfully notes that Russell et al. disclose a clock signal as recited in the claims because they disclose that "the down-conversion and up-conversion are implemented by mixing the signal with a local oscillator (LO)" (column 30, lines 61-62), wherein the LO frequency is established by reference clock signals (column 31, lines 3-9).

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicants are reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christina Y. Leung whose telephone number is 571-272-3023. The examiner can normally be reached on Monday to Friday, 6:30 to 3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 571-272-3022. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-2600.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Christina Y Leung
Christina Y Leung
Patent Examiner
Art Unit 2633

Approved
CL 8-2005

REPLACEMENT SHEET

FIG.5